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ELECTRO - OPTICS RESEARCH & DEVELOPMENT UNIT

ACOUSTIC SOUNDING SYSTEM FOR LONG RANGE PROPAGATION IN MIDDLE EAST SURROUNDINGS

Second Interm Report

Item 0002

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13.ABSTRACT(MAXIMUM 200 WORDS)
This report covers work carried out during the second interim period. Two main tasks were carried out during this period. The first task dealt with the design and building of the Acoustic Power Source (APS) based on standard horn elements. The radiation pattern of the source was measured over an azimuth of 70 degrees surrounding the main lobe in the frequency range from 120 - 2,000 Hz. The second task dealt with the experimental determination of direction finding using the Acoustic Directive Receiver Antenna (ADRA). Representative graphs of the APS radiation pattern and a table containing measured direction angle versus geometrically determined source location are included. The effective beam width varied from 30°-60°. Direction accuracy was determined to within 5°.

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Second Interim Report

This report briefly describes the design and field measurement activities carried out during the second interim period. The two main tasks preformed were the experimental determiation of the APS radiation pattern and the ADRA direction finding capability under field conditions.

1. The Acoustic Power Source -APS

1.1 The maximum acoustical power from a single Atlas/Soundolier horn (DR72) using a PD-60T driver was determined at a distance of 2m and as a function of frequency. The measured results are given in Table 1 (see Appendix 1).

1.2 In order to evaluate mutual coupling effects between the elements in a linear array mode, a linear arrangement of 3 horns was chosen as a representative unit. Adjacent horns were spaced at distances varying from 5 - 20cm. In addition rectangular slabs from different materials namely Aluminum, Wood and Polyurethene-foam were used as partitions beteween horns.

1.3 The acoustic radiation pattern of the above source was determined as follows. A set of 8 microphones, equally spaced at 10° angles and at a radial distance of 30m from the horn array were used to simultaneously measure the acoustic signal. The source was driven at several frequencies in the range from 120-2,000 Hz.

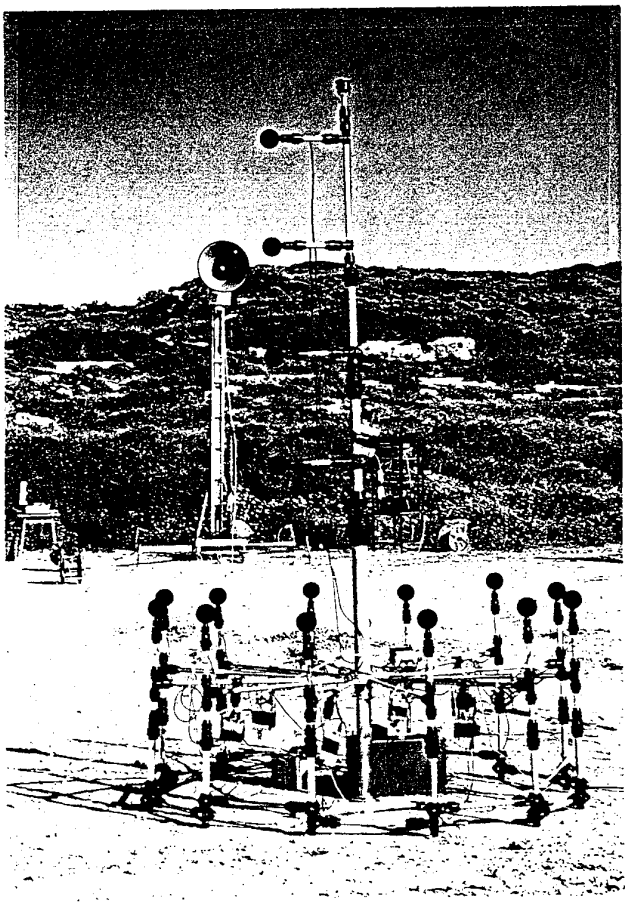
1.4 The measurenents were arranged over 4 segments (of duration 2sec. each) and the results obtained from the 5cm spacing and no partition configuration is given in Appendix 1. In the graphs the azimuth angle of 0° corresponds to the direction directly in front of the horns. These results are representative in nature. A detailed analysis of all the configurations will be carried out to determine the optimal design for the complete 6 - element array.

2 The Acoustic Directive Receiver Antenna (ADRA)

2.1 The direction finding capability of the ADRA was determined experimentally as follows.
A single horn source driven at 300 Hz was positioned at various azimuthal and vertical positions around the antenna, in the far field. See attached photograph of the experimental set up.

2.2 The geometrical coordinates of the source with respect to a reference microphone of the horizontal array was determined. The source was moved with respect to the antenna array and its coordinates determined at each position.

2.3 The results obtained from this field experiment are given in Table 2 (see Appendix 1) The geometrical direction coordinates are compared with the source direction coordinates as detemined by the ADRA system.
From Table 2 we see that the agreement between the two in the azimuthal plane is within 3°. In the vertical plane the agreement is within 5°.



3. The next stages of the research

The following are the main tasks we plan to perform in the next stages of the research:

1. Completion of radiation analysis of the 3 horn source.
2. Constructing of the APS.
3. Preliminary long range acoustical propagation measurements.
4. Computer simulation and comparison with long range acoustic transmission measurements.

APPENDIX 1

Table 1

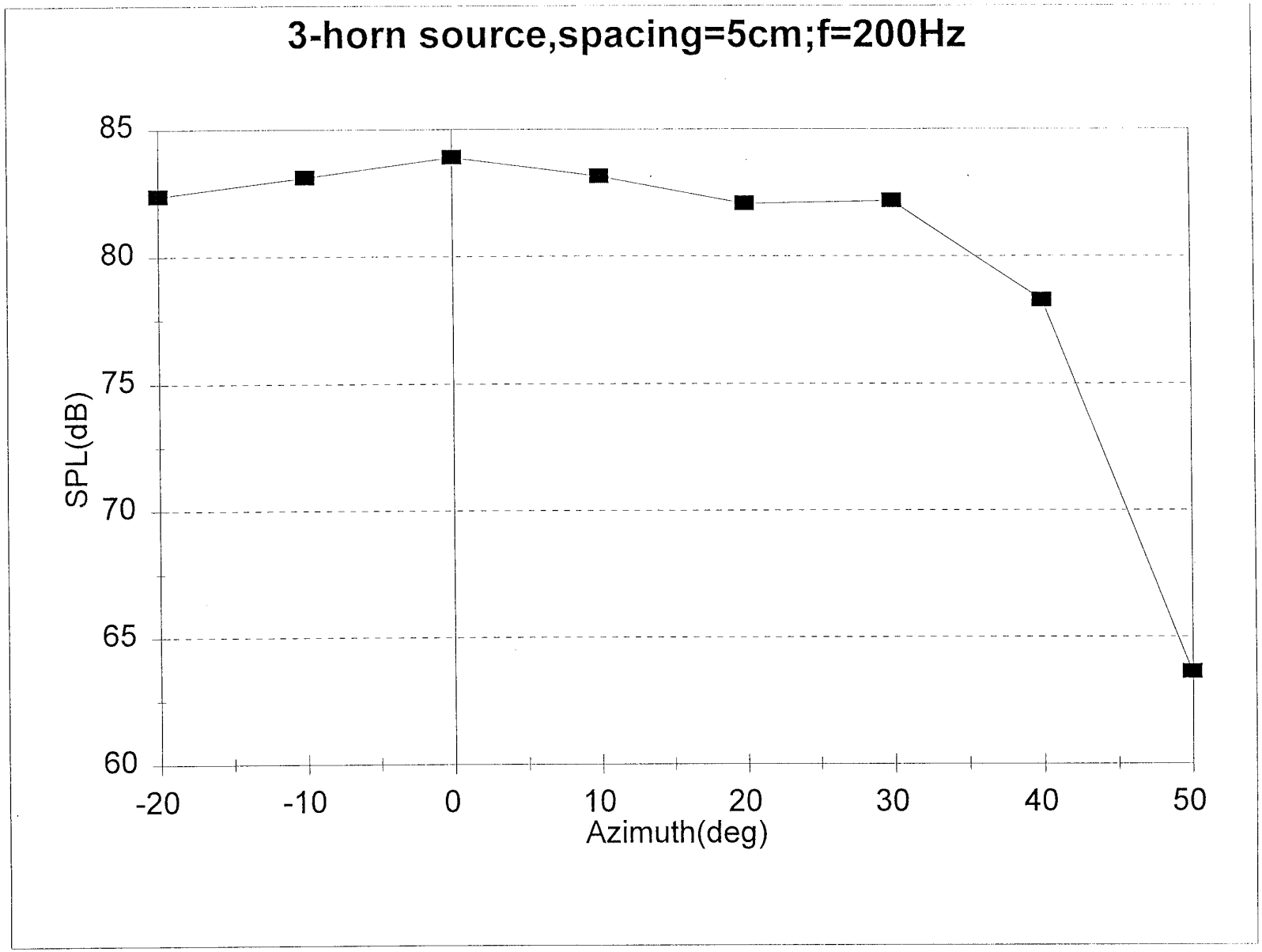
FREQUENCY (Hz)	SPL (dB ze $2 \cdot 10^{-5}$ N/m^2)
1,000	130
500	121.2
250	105
200	110.2
160	121.8
150	117.8
125	105

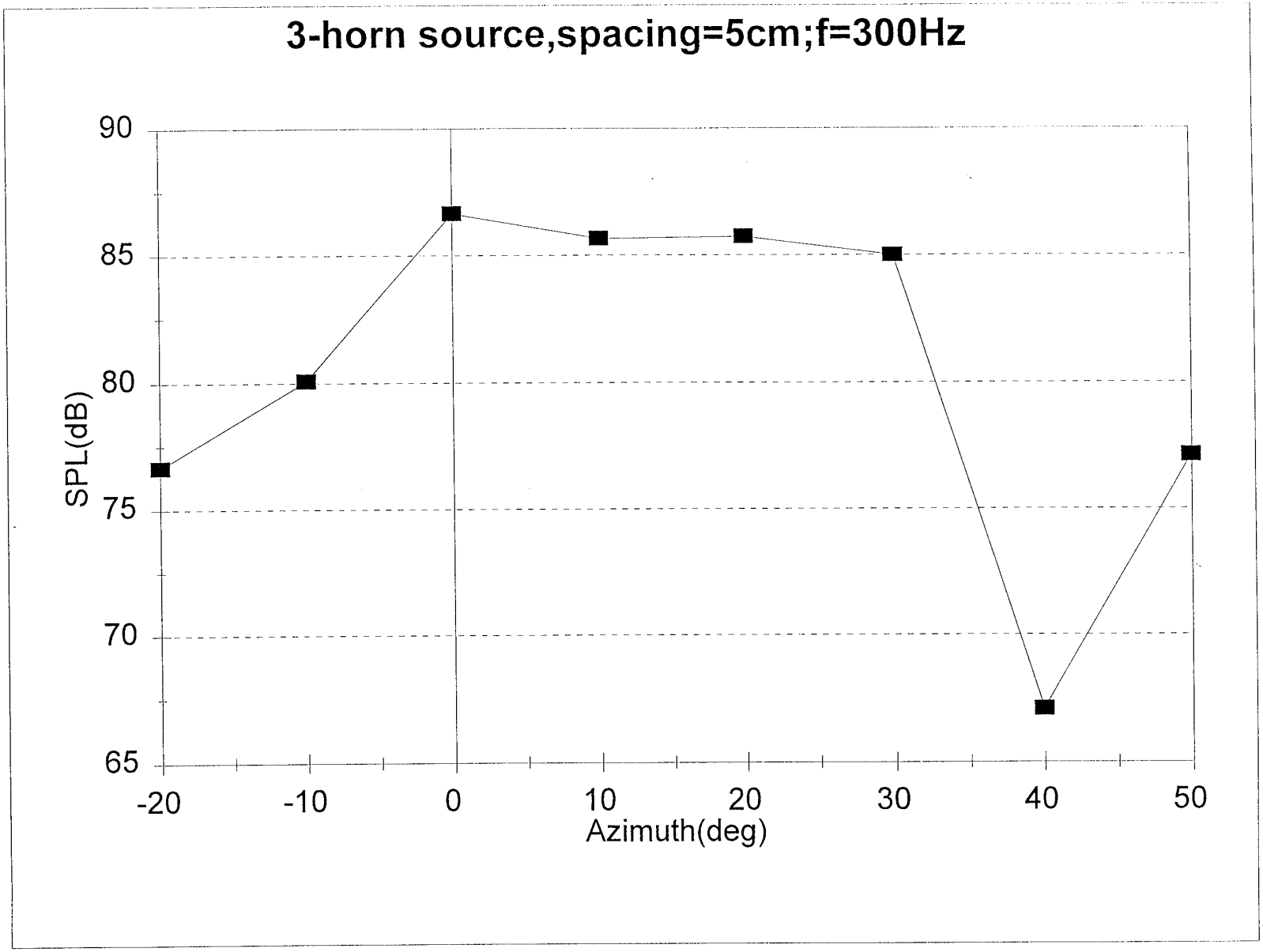
Sound pressure levels measured at 2 m from a single horn and driven at different frequencies.

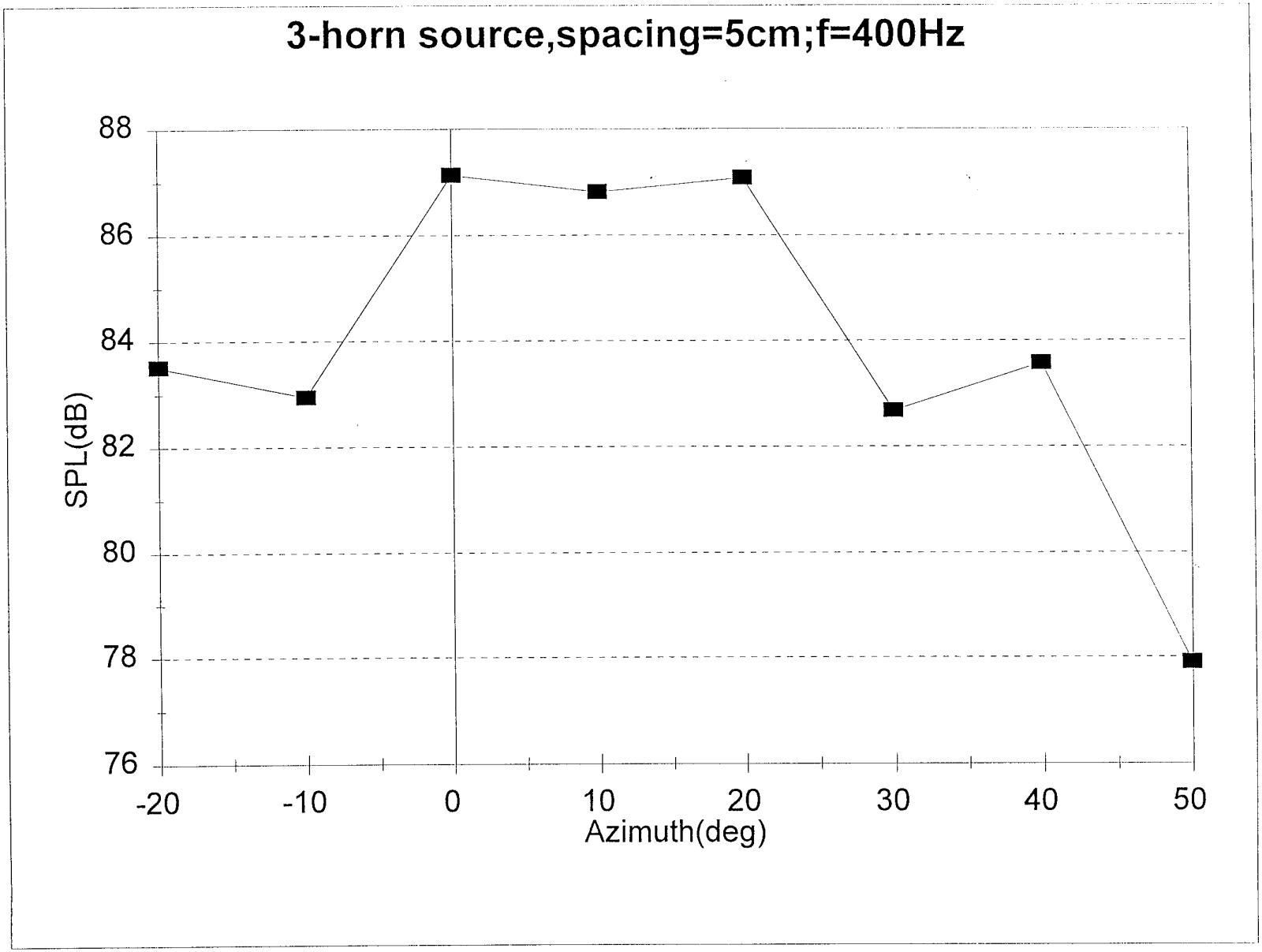
Table 2

AZIMUTH ANGLE (DEG)		ZENITH ANGLE (DEG)	
Determined Geometrically	Determined by ADRA	Determined Geometrically	Determined by ADRA
0	0	0	0.5
15	13.5	9.6	13.5
30	32	20.3	25
45	48		
60	61.5		
75	75		
90	91.5		
120	120		
150	148		
180	178.5		

Comparison of geometric direction with that obtained from the ADRA system.


3-horn source,spacing=5cm;f=200Hz
85
80
75
70
65
60
SPL(dB)
-20
-10
0
10
20
30
40
50
Azimuth(deg)


3-horn source,spacing=5cm;f=300Hz
90
85
80
75
70
65
SPL(dB)
-20
-10
0
10
20
30
40
50
Azimuth(deg)


3-horn source,spacing=5cm;f=400Hz
88
86
84
82
80
78
76
SPL(dB)
-20
-10
0
10
20
30
40
50
Azimuth(deg)